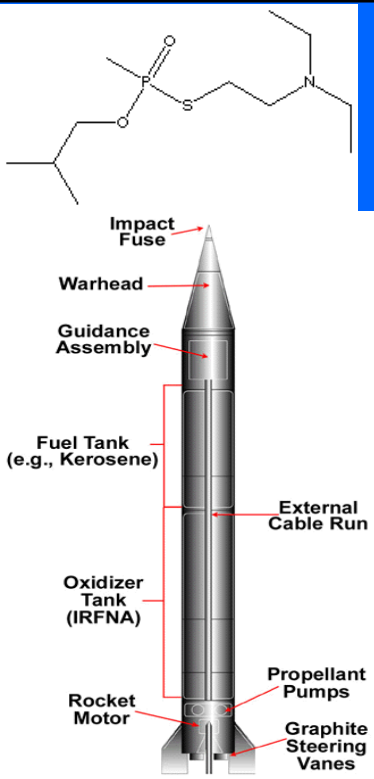


# NEW CHEMICAL DETECTION TECHNOLOGY

FORTY-FOURTH NAVY OCCUPATIONAL  
HEALTH AND PREVENTIVE MEDICINE  
CONFERENCE

LT Parrish, MSC USN  
NEHC-IH  
0915-0940, EPM & IH  
INTERDISCIPLINARY  
MORNING SESSION



# Topics

- 9 Desired Equipment Characteristics-background
- Role of DOD SBIR/STTR Process
- Review of several new detection devices
- 20 minute break
- Review of several other new detection devices

# State of Research

- Most new items on market are re-packaged technology:
  - Smaller/lighter/faster
  - Lower power requirements
  - Higher discrimination/fewer false positives
  - More field capable
  - More able to detect wider range of chemicals

# Technologies

- Ion Mobility Spectrometers (IMS)
- Flame Spectrophotometer
- Photoionization Detectors (PID)
- Surface Acoustic Wave (SAW)
- GC-MS – several variants, van-mounted, benchtop, & man-portable.
- Infrared- point & standoff.

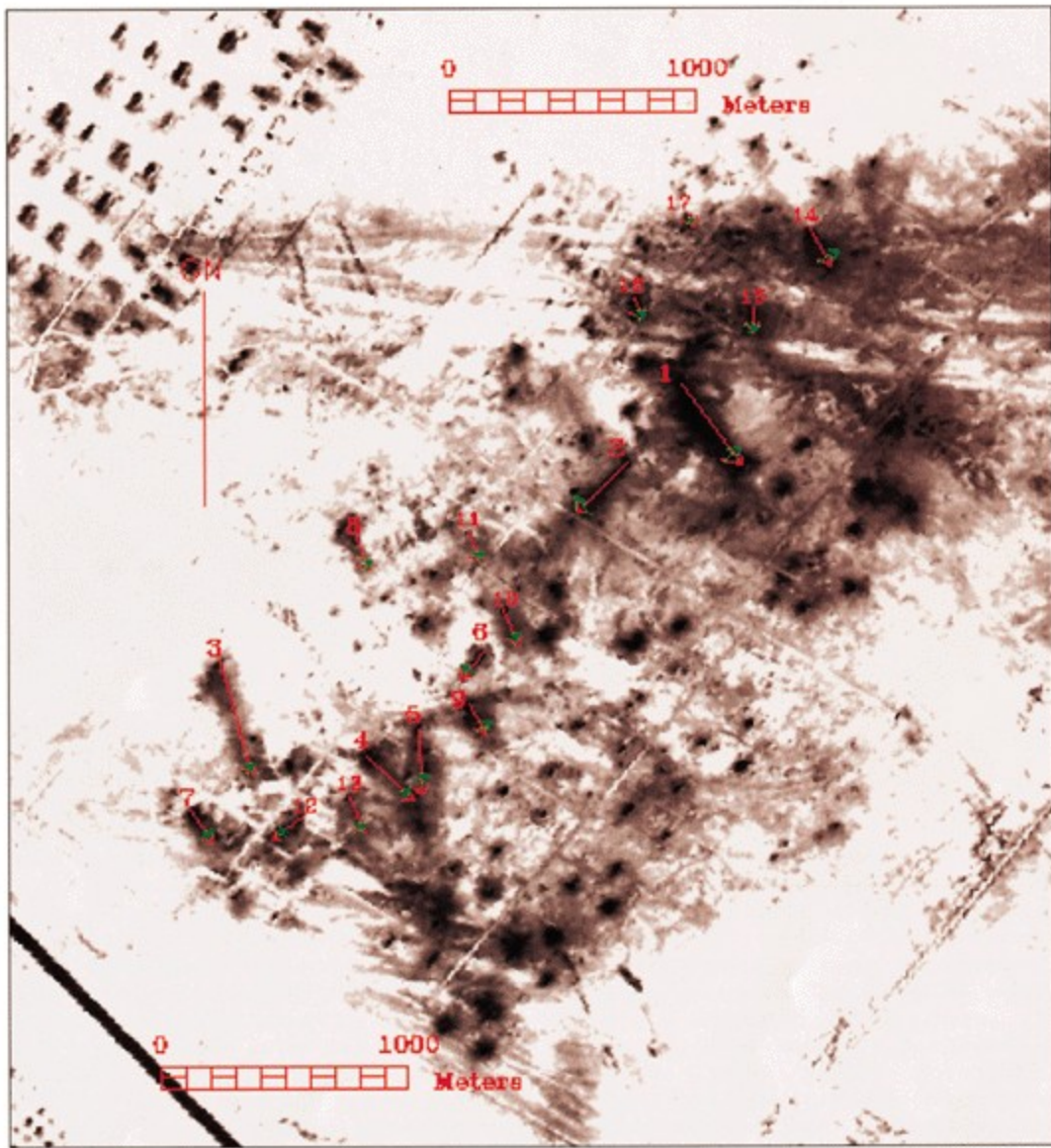
# CWA/TIC Threat



# US

requires  
better  
CWA/TICs  
field  
detection  
systems.

Figure 6  
Khamisiyah Bunker Soot Patterns—10 March 1991



# Chemical Detection

- Focus areas in research & production
  - CWAs
  - TICS/TIMS
  - Point detection & force health protection/  
health risk assessment
- Acquisition Programs
  - SBIR
  - STTR
- Commercial research- high \$  
investments

# Sample Extraction Techniques

- Decreased extraction times.
- Increased sensitivity, wide range of chemicals.
- Usable in field or lab situation
  - Less reliance on liq/liq, Soxhlet, traditional.
- Inexpensive.
- SPME, SPE, new polymers, thermal desorption.
- Helical SPME for TWA- badge system?

# 9 Desired Instrument Properties

- Low Limit of Detection & Noise Level
- High Sensitivity
- Insensitive to Interferences
- Wide Linear Range
- Quick Detector Response
- High Accuracy, Repeatability, Reliability

# SBIR

- Small Business Innovation Research- funds early-stage R&D at small technology companies.
- Stimulate technological innovation.
- Increase private sector commercialization of federal R&D.
- Increase small business participation in federally funded R&D.
- Foster participation by minority and disadvantaged firms in technological innovation.

# Small Business Technology Transfer

- STTR is similar in structure to SBIR but funds *cooperative* R&D projects involving a small business and a research institution.

# SBIR, Phase I

- Determines scientific, technical, and commercial merit and feasibility of submitted ideas.
- \$60,000 to \$100,000 over 6 – 9 months.
- Goal- significant contributions to proving the scientific, technical, and commercial feasibility of the proposed effort,
- Interim goal: further DoD support in Phase II.
- Final goal- product or process of continuing importance to DoD and the private sector.

# SBIR Phase II

- Based on Phase I results & scientific, technical, and commercial merit of Phase II proposal.
- \$500,000 to \$750,000, up to 2 year duration.
- Phase II- principal research/R&D effort
  - Goal- well-defined, deliverable prototype.

# Spectroscopy

- Several new innovative systems available.
- Benchtop and portable units inwork and/or commercially available.

# EIC Labs, Surface-Enhanced RAMAN Spectroscopy

- DTRA SBIR, Phase 1, 2000, Phase 2, 2002.
- Developed vapor phase SERS.
  - 5 ppb vapor in < 30 s gas sensing technology to locate TNT-based landmines.
  - Detects HMX, PETN, and TATB, & processing chemical tributyl phosphate.
- Phase 1 Goals 1) Reproducibility,
  - 2) Negligible chemical interferences
  - 3) Detection of encased samples.
  - 4) Vapor Detection, CWAs /Explosives
- Phase II -Complete spectral library
  - Fabricate transportable SERS system with sensor

# Foster Miller, Inc. COHERENT Ultraband THz SPECTROSCOPY, FAR-INFRARED, CHEMICAL DETECTION

- USAF, SBIR Phase 1, 2003.
- TeraHertz Spectroscopy - non-ionizing probe for personnel/ packages, no health risks, compositional analysis/auto recognition.
- Laser-based Continuous THz system -real-time interrogation of packages/personnel, complementary transmissive/reflective modes.
- Phase I: Table-top system testing of software, hardware.

# Foster-Miller, WEDGE-SPECTROMETER, INFRARED, FIBER OPTIC PROBES

- Army SBIR, Phase 1, 2001
- Miniature mid-infrared spectrometer coupled to tiny fiber optic sensor probes.
- Identify/qualitatively characterize broad range of CWA/TICs.
- Size of a small pocket calculator.
- Phase II, optimize field unit + library.

# Implant Sciences Corp, Ion Mobility Spectrometry Non-Radioactive QS™

- Army SBIR Phase 1, 2002 (\$120K). Navy + Army SBIR Phase 2, 2003 (\$730K).
- Advanced vapor detection sensor for major explosives TNT, RDX, PETN, etc. < 3 sec.
- Phase I: Developed prototype cyclone sampling system interfaced to Laser IMS system.
  - Detected ppm/ppb TNT and RDX in 2 soil types.
- Phase II: Optimize design for field-portable unit.

# AVIR LLC, TOVA

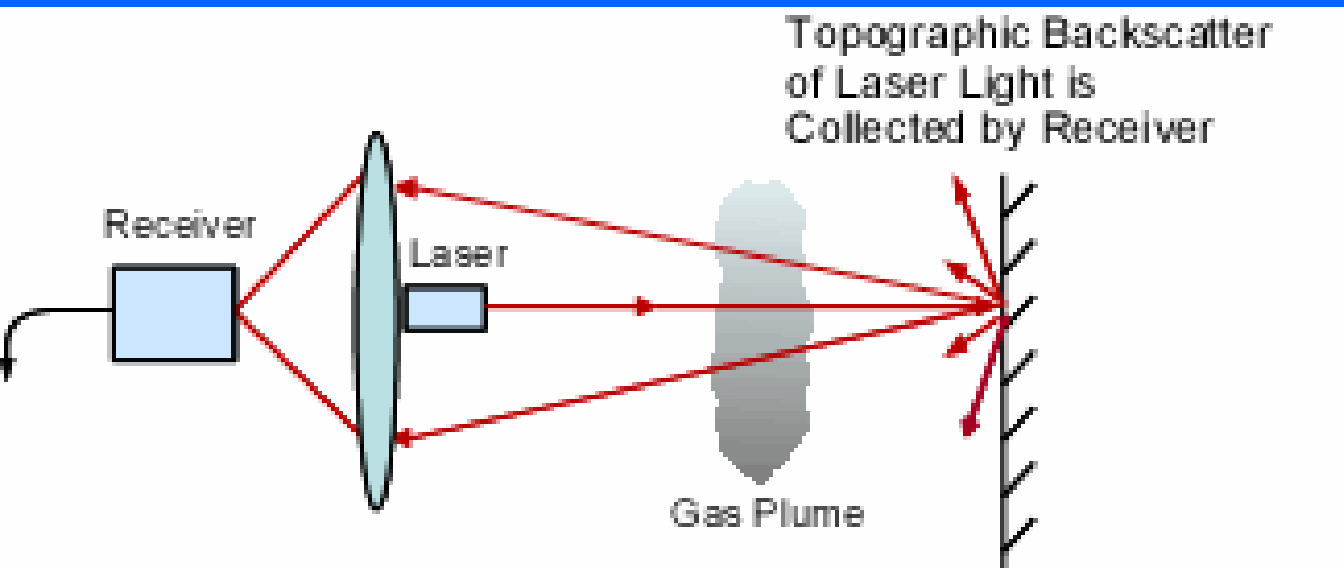
- TSWG. \$1.1M, 2004.
- Low-cost, hybrid monitor for TICS in building HVACs.
- Uses differential absorption radiometry (DAR), passive or active IR in the totally optical vapor analyzer (TOVA<sup>™</sup>).

# Physical Sciences, Inc, AOTF Based Imaging Sensor for Enhanced Stand-off Chemical

- Army SBIR, Phase 1, 2003
- Developed acoustic-optic tunable filter (AOTF) for imaging spectroscopy, 8-11 micron thermal infrared spectral region.
- Couples AOTF instrument to cryo-cooled HgCdTe infrared detector.
  - High responsivity
  - Low noise.

Phase 1 Goals: Spectral resolution 8 – 10/ cm.

# Physical Sciences Inc. Portable Standoff Hazardous Gas Detector



# Optra – Joint Service Lightweight Standoff Chemical Agent Detector (JSLCAD)



- Prototype passive infrared spectrometer.
- 7 to 14 micron spectral region.

# Spectral Imaging Lab, Miniature, HiRes UV to Vis Imaging Spectrometer

- USAF SBIR, Phase 1, 2003.
  - 2 Miniature, high resolution imaging spectrometers.
  - Remote detection of chemical vapors, 200-800 nm band.
1. Diffraction grating, resolution of 0.39 nm.
    - S/N 400 and 1000 in 20 msec. 8.55 in<sup>3</sup> volume.
  2. Spatial-heterodyne Fourier transform spectrometer.
    - Resolution of 2.5/cm (0.01 nm at 200 nm and 0.16 nm at 800 nm).
    - Field widened spectrometer, opens entrance slit to increase throughput.
    - S/N 100-1300 in 20 msec. 4.86 in<sup>3</sup> volume.

# Spectral Imaging Lab. Thermal Infrared Imaging Spectrometer

- Army SBIR, Phase 1 2002, Phase 2 2003.
- Remote detection & ID of surface contaminants.
- High power, pulsing CO<sub>2</sub> laser to vaporize liquids.
  - Scans target scene
  - 3D spectral-images.
- Pre-programmed library of contamination filters, automatically identify contaminants.
- 30° field of view, 14 kg, 80 watts.

# CAVITON

## Field Chemical Analysis Tool

- **Navy 2003 Phase I SBIR award.**
- Emission spectroscopy-based micro-discharge sensors + GC.
- Rapid detection of chemical agents in the field.
- Micro-discharge detectors are rapid, real-time sensors, ppb detection, wide range of atomic and molecular species.
- Goal: self contained, battery operated, field deployable.

# Dynamics Technology, Inc. (DTI)

- Demonstrated a man-portable Associated Particle Analysis (APA) system
- Use neutron beams for through-barrier detection & classification
  - Explosives, CWAs, TICS.
- Unique material penetration, detailed material identification, and operational portability.
- TSWG grant. 2004. \$3.8M

20 minute break

Please be back at  
1000.